U. S. ARMY TEST AND EVALUATION COMMAND
ENVIRONMENTAL TEST PROCEDURE

ARCTIC ENVIRONMENTAL TEST OF INDIRECT FIRE WEAPONS (MORTAR)

1. OBJECTIVE

The objective of the procedures outlined in this MTP is to provide a means of evaluating the performance of indirect fire weapons (mortars) under arctic winter environmental conditions.

2. BACKGROUND

Engineering tests of indirect fire weapons are conducted to determine the characteristics and performance of the ammunition under various conditions of operation, and to ensure their compliance with specified requirements. Testing in a natural arctic winter environment is used to substantiate or supplement data obtained from simulated tests conducted during the Engineer Design and Engineering Test phase. Testing in the arctic winter environment generally is not authorized until data from simulated environment tests provides reasonable assurance that the test item will function satisfactorily when subjected to the conditions that would be encountered in the arctic.

3. REQUIRED EQUIPMENT

a. Appropriate Arctic winter uniforms and individual field gear.
b. Weapons (comparison).
c. Ammunition.
d. Vehicles (cargo).
e. All general and special tools and ancillary items required to perform maintenance on the test item.
f. Test equipment as required.
g. Photographic equipment (black and white or color).
h. Meteorological support facility.
i. Rate of fire recorder.
j. Shot group computer.

4. REFERENCES

A. AMCR 385-12, Verification of Safety of Materiel From Development Through Testing, Production, and Supply to Disposition.
B. AMCR 385-224, AMC Safety Manual
C. AR 70-8, Human Factors and Social Sciences Research.
D. AR 70-10, Army Materiel Testing.
E. AR 705-5, Army Research and Development.
F. AR 705-15, Operations of Materials Under Extreme Conditions of Environment.
G. AR 750-6, Maintenance Support Planning.
H. USATECOM Regulation 350-6, Training in New or Modified Equipment and Training Devices.

I. USATECOM Regulation 385-6, Safety Release.
J. USATECOM Regulation 385-7, Safety Confirmation.
K. USATECOM Regulation 385-8, Training of Test Personnel.
L. USATECOM Regulation 705-2, Documenting, Test Plans and Reports.
M. MTP 10-4-500 Arctic Preoperational Inspection, Physical Characteristics, Human Factors, Safety and Maintenance Evaluation.

5. SCOPE

5.1 SUMMARY

The procedures outlined in this MTP are designed to determine and evaluate the functioning characteristics of indirect fire weapons (mortars) under arctic winter environmental conditions.

The specific tests to be performed and their intended objectives are listed below:

a. Preoperational Inspection and Physical Characteristics - This subtest provides for an inspection of the test item to determine:

1) If the test and comparison (control) items are in proper condition for testing.
2) If the test items physical characteristics conform to applicable criteria.

b. Firing Test - The objective of this subtest is to determine the accuracy and suitability for rapid fire employment under arctic winter environmental conditions.

c. Position Disclosing Effect - The objective of this subtest is to determine and measure the position disclosing effect created by the cumulative smoke, muzzle flash, ice fog and sound of the test weapon when fired under arctic winter environmental conditions.

d. Functional and Operational Suitability - The objective of this subtest is to determine the ease of carrying and transporting the test weapon cross-country and over ski trails while wearing snowshoes and skis.

e. Human Factors Engineering - The objective of this subtest is to determine if all accessories and components of the test weapon enable easy operation by test personnel wearing the appropriate arctic winter uniform.

f. Maintenance Evaluation - The objective of this subtest is to determine if the test ammunition meets maintenance and maintainability requirements as defined by QMR, SDR, TC, MC or other established criteria under arctic winter environmental conditions.

5.2 LIMITATIONS

The procedures described in this MTP are limited to the testing of

indirect fire weapons (mortars) under arctic winter environmental conditions. Specific tests for others may be performed using this MTP as a guide with variations applicable to the weapon to be tested.

6. PROCEDURES

6.1 PREPARATION FOR TEST

a. Since arctic winter environmental tests are normally scheduled from October through March (6 months), ensure that the test and comparison weapons are delivered to the Arctic Test Center prior to 1 October.

b. TDY personnel shall be used to augment assigned personnel and shall be trained to the degree that they are as proficient on the individual weapons as the troops who will use the weapon.

c. Ensure that all test personnel are familiar with the required technical and operational characteristics of the item under test, such as stipulated in Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), and Technical Characteristics (TC), and record this criteria in the test plan.

d. Review all instructional material issued with the test item by the manufacturer, contractor, or government, as well as reports of previous tests conducted on the same type of equipment, and familiarize all test personnel available for reference.

e. Record the grade, MOS, background, and training of all test personnel and ensure that all personnel receive new equipment training (NET) as referenced in 4H.

f. Record the following information:

1) Nomenclature, serial number(s), and manufacturer's name of the test items.
2) Nomenclature, serial number(s), accuracy tolerances, calibration requirements, and last date calibrated of the test equipment selected for the tests.

g. Select test equipment ideally having an accuracy 10 times greater than that of the function to be measured.

h. Prepare record forms for systematic entry of data, chronology of tests, and analysis in final evaluation.

i. Prepare adequate safety precautions to provide safety for personnel and equipment, and ensure that all safety SOP's are observed throughout the test. Ensure that a Safety Release has been obtained prior to test conduct.

j. Outfit all test personnel in appropriate arctic winter clothing as described in MTP 10-4-500, and with individual field equipment, during all weapon testing.

k. Ensure that when not in use, all test and comparison weapons are stored and maintained in an unsheltered area and exposed to ambient air temperature and prevailing weather conditions.

l. Record the prevailing meterological conditions during the storage phase, as well as test conduct, to include:

1) Temperature
2) Humidity, relative or absolute
3) Temperature gradient
4) Atmospheric pressure
5) Precipitation
6) Solar radiation
7) Wind speed and direction
8) Frequency of readings
9) Source of data
10) Time in storage

6.2 TEST CONDUCT

6.2.1 Preoperational Inspection and Physical Characteristics

a. Upon receipt, carefully inspect all test items and comparison weapons and their shipping or packaging containers for completeness, damage and general conditions in accordance with the applicable sections of MTP 10-4-500.

6.2.2 Firing Tests

6.2.2.1 Accuracy

a. Cold-soak (outdoors for a period of at least 24 hours) all tests and comparison weapons.

NOTE: Each phase of the subtest shall be conducted in ambient air temperature of 0°F to -25°F, -25°F to -45°F, and -45°F to the lowest available temperature.

b. Emplace the test weapons on the firing line.

c. Position observers at various points down range to observe the point of impact.

d. Lay the weapons at the required range using appropriate sighting device and aiming stakes. Record any difficulties encountered.

e. Order the test personnel to fire three ten-round shot groups at minimum, intermediate and maximum ranges in each temperature range.

Repeat the above steps using the comparison weapon.

Record the following data:

1) Ambient air temperature
2) Wind velocity and relative direction to mortar
3) Center of impact for each shot group
4) Probable error in range
5) Probable error in deflection
6) Type of weapon
7) Number of rounds fired
8) Weapon malfunctions
9) Difficulties encountered in laying the weapon

6.2.2.2 Rapid Fire Employment

a. Repeat steps a through d of paragraph 6.2.2.1

b. Order the test personnel to fire a minimum of three fifteen-round shot groups (rapid rate of fire) at minimum, intermediate and maximum ranges in each temperature range.

c. Repeat the above steps using comparison weapons.

d. Record the data as described in paragraph 6.2.2.1, in addition to the following:

1) Time required to fire each rapid fire exercise.
2) Difficulties encountered during firing.

6.2.3 Position Disclosing Effect

a. Cold soak (outdoors for a period of at least 24 hours) all test and comparison weapons.

b. This subtest shall be conducted in ambient air temperature of 0°F to the lowest available temperature.

c. Mount cameras, perpendicular to the muzzle of the test weapons at a sufficient distance to photograph the flash.

d. Position an observer behind each mortar and down range along one flank of the safety fan at range of 100, 200, 300, 400, 500 and 600 meters.

NOTE 1: This subtest shall be conducted currently with the firing test.
NOTE 2: Conduct this portion of test under darkened conditions.

e. Order the test personnel to fire and photograph the cumulative flash from each weapon.

f. Record the following:

1) Smoke, ice, fog and flash at firer positions.
2) Sound, smoke and flash effects visible to the observers at indicated ranges.
3) Annotations to the photographs of cumulative flash with regard to variations to flash during the test.
4) Ambient air temperature at test site.
5) Light conditions (daylight or darkness).
6) Wind velocity and relative direction in relation to gunner.
7) Duration of position disclosing effects.

g. Repeat steps (c) through (f) above, utilizing the comparison weapons.

h. Repeat steps (c) through (f) above, under daylight conditions but without photographing the cumulative flash.

6.2.4 Functional and Operational Suitability - Portability

a. Cold soak (outdoors for a period of at least 24 hours) all test and comparison weapons.

b. This test shall be conducted in ambient air temperature of 0°F to the lowest available temperature.

c. Inspect all test and comparison weapons for loose, damaged or missing parts and place in the best possible condition.

d. Pack the test and comparison weapons in the prescribed carrying case and transport over the following courses:

1) Snowshoe one (1) mile through dense, snow-covered brush.
2) Snowshoe two (2) miles over open-covered (cross-country) terrain.
3) Ski three (3) miles over cross-country ski trails.
4) 50 miles in tracked vehicles over cross-country trails.

e. Thouroughly inspect each test item for loose, damaged or missing parts, and record the following:

1) Damaged attributed to environmental effects.
2) Problems encountered while transporting and emplacing the mortars.
3) Damage to the mortars due to handling.
4) Temperature at test site.
5) Total mileage accrued during transporting.

6.2.5 Human Factors Evaluation and Safety

a. Conduct all Human Factors and Safety tests in accordance with the applicable sections of MTP 10-4-500 and include the following:

1) Five test soldiers (gunners) wearing the arctic mitten, shell leather gloves, and anti-contact gloves shall conduct five firing exercises to determine the ease of performing large and small deflections, elevation changes, and mounting and dismounting the weapon.

b. Conduct these tests concurrently with the operational tests (Firing, Position Disclosure, Functional and Operational Suitability-Portability, as described in this MTP).

6.2.6 Maintenance Evaluation

a. Conduct all maintenance evaluation tests (maintenance and reliability) in accordance with applicable sections of MTP 10-4-500.

b. Conduct these tests concurrently with the operational tests (Firing, Position Disclosure, Functional and Operational Suitability-Portability, as described in this MTP).

6.3 TEST DATA

All test data to be recorded will be as specified in the individual subtests of this MTP.

6.4 DATA REDUCTION AND PRESENTATION

Processing of raw test data shall, in general, consist of organizing marking for identification and correlation, and grouping the test data according to test title.

Specific instructions for the reduction and presentation of individual test data are outlined in the succeeding paragraphs.

6.4.1 Preoperational Inspection and Physical Characteristics

Preoperational inspection and physical characteristics data shall be reduced and presented in accordance with MTP 10-4-500.

6.4.2 Firing Tests

Compare center of inpact, probable error in range and deflection to weapon specifications for possible deviations due to effects of arctic winter environmental conditions.

6.4.3 Position Disclosing Effect

Compare data obtained from the test ammunition to the data obtained from the comparison ammunition and also against accepted military standards.

6.4.4 Functional and Operational Suitability-Portability

The operation of the weapon under test in extreme arctic winter conditions shall be determined by comparison with previously accepted items of like nature and specifications. The damage to the weapon attributed to environmental effects of handling shall be compared with weapon specifications contained in appropriate QMR and TC.

6.4.5 Human Factors Evaluation and Safety

Human Factors and Safety data shall be reduced and presented in accordance with MTP 10-4-500.

6.4.6 Maintenance Evaluation

Maintenance data shall be reduced and presented in accordance with MTP 10-4-500.